

We claim:

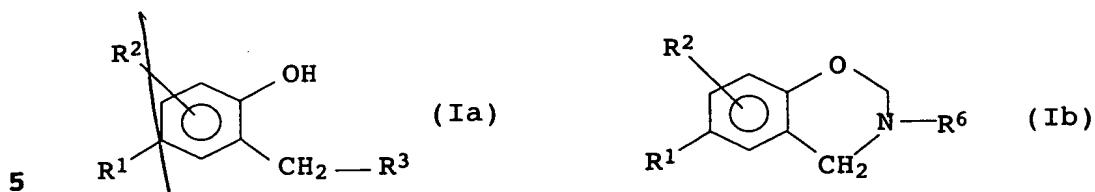
1. A process for the preparation of  
5 polyisobutenyphenol-containing Mannich adducts by  
a) alkylation of a phenol with polyisobutene having more  
than 70 mol % of vinylidene double bonds and a number  
10 average molecular weight of from 300 to 3000 at below  
about 50°C in the presence of an alkylation catalyst;  
b) reaction of the reaction product from a) with  
15 formaldehyde, an oligomer or a polymer of formaldehyde  
and  
20 at least one amine which has at least one secondary amino  
function and no primary amino function  
or  
25 c) reaction of the reaction product from a) with at least  
one adduct of at least one amine which has at least one  
secondary or primary amino function and formaldehyde, an  
oligomer of formaldehyde, a polymer of formaldehyde or a  
formaldehyde equivalent.

Sub A1

2. A process as claimed in claim 1, wherein the amine used is  
30 3-(dimethylamino)-n-propylamine,  
di[3-(dimethylamino)-n-propyl]amine, dimethylamine,  
diethylamine, di-n-propylamine or morpholine.

3. A process as claimed in claim 1, wherein, in step c), the  
35 adduct used is an aminal of formaldehyde with a secondary  
amine, selected from di-C<sub>1</sub>-C<sub>8</sub>-alkylamines whose alkyl groups  
may be substituted by an N(C<sub>1</sub>-C<sub>4</sub>-alkyl)<sub>2</sub> group, and cyclic  
amines, which have 4 to 6 carbon atoms and whose cyclic  
structure may be interrupted by O and/or N-C<sub>1</sub>-C<sub>4</sub>-alkyl.

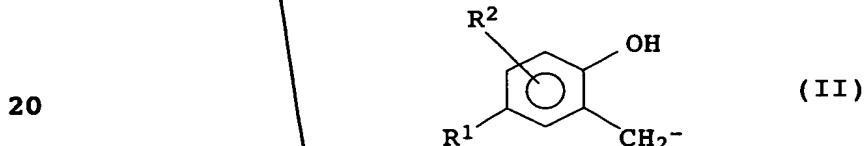
4. A process as claimed in any of the preceding claims, wherein  
40 an adduct mixture is obtained which comprises at least  
40 mol% of compounds of the formula Ia and/or Ib,



where

10  $R^1$  is a terminally bonded polyisobut enyl radical,  
 $R^2$  is H,  $C_1$ - to  $C_{20}$ -alkyl,  $C_1$ - to  $C_{20}$ -alkoxy, hydroxyl, a polyalkylenyl radical or  $CH_2NR^4R^5$ , where  $R^4$  and  $R^5$  have the meanings stated below, and

15  $R^3$  is  $NR^4R^5$ , where  $R^4$  and  $R^5$ , independently of one another, are selected from H,  $C_1$ - to  $C_{20}$ -alkyl,  $C_3$ - to  $C_8$ -cycloalkyl and  $C_1$ - to  $C_{20}$ -alkoxy radicals which may be interrupted and/or substituted by heteroatoms selected from N and O, and phenol radicals of the formula II



where  $R^1$  and  $R^2$  are as defined above; with the proviso that  $R^4$  and  $R^5$  are not simultaneously H or phenol radicals of the formula II; or  $R^4$  and  $R^5$ , together with the N atom to which they are bonded, form a 5-, 6- or 7-membered cyclic structure which has one or two heteroatoms selected from N and O and may be substituted by one, two or three  $C_1$ - to  $C_6$ -alkyl radicals; and

30  $R^6$  is a radical  $R^4$  or  $R^5$  other than H.

5. A process as claimed in any of the preceding claims, wherein a Mannich adduct having a polydispersity of from 1.1 to 3.5 is obtained.

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6. A process as claimed in any of the preceding claims, wherein, in step c), an adduct which is obtained from at least one amine and formaldehyde, an oligomer of formaldehyde, a polymer of formaldehyde or a formaldehyde equivalent by reacting the two reactants for at least 15 minutes at above  $+15^\circ C$  is used.

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7. A process as claimed in any of claims 1 to 6, wherein the reaction mixture from b) or c) is fractionated by column chromatography over an acidic stationary phase by multistage elution with

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- at least one hydrocarbon and then
- at least one basic alcohol/water mixture.

8. A process as claimed in claim 7, wherein the basic  
5 alcohol/water mixture used is a mixture of

10 a) from 75 to 99.5% by weight of at least one C<sub>2</sub>- to  
C<sub>4</sub>-alcohol,  
b) from 0.4 to 24.4% by weight of water and  
c) from 0.1 to 15% by weight of at least one amine which is  
volatile at room temperature.

15 9. A process as claimed in any of the preceding claims, wherein  
the adduct mixture obtained includes from 0 to 20, preferably  
1 to 15, mol% of polyisobutenyphenols from reaction step a)  
which are not reacted further.

20 10. A Mannich adduct obtainable by

25 a) alkylation of a phenol with polyisobutene having more  
than 70 mol % of vinylidene double bonds and a number  
average molecular weight of from 300 to 3000 at below  
about 50°C in the presence of an alkylation catalyst;  
b) reaction of the reaction product from a) with  
formaldehyde, an oligomer or a polymer of formaldehyde  
and at least one amine which has at least one secondary  
amino function and no primary amino function.

30 11. The use of a Mannich adduct as claimed in claim 10 as a  
detergent additive in fuel and lubricant compositions.

35 12. An additive concentrate containing, in addition to  
conventional additive components, at least one Mannich adduct  
as claimed in claim 10 in amounts of from 0.1 to 99.9% by  
weight, preferably 0.5 to 80% by weight.

40 13. A fuel composition containing a main amount of a liquid  
hydrocarbon fuel and an amount, having detergent activity, of  
at least one adduct as claimed in claim 10.

45 14. A lubricant composition containing a main amount of a liquid,  
semisolid or solid lubricant and an amount, having detergent  
activity, of at least one adduct as claimed in claim 10.

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15. The use of a fuel composition as claimed in claim 13 as a  
~~gasoline or diesel fuel~~

5 add A4 >

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## Preparation of polyisobut enylphenol-containing Mannich adducts

## 5 Abstract

Polyisobut enylphenol-containing Mannich adducts are prepared by

10 a) alkylation of a phenol with highly reactive polyisobutene at  
below about 50°C in the presence of an alkylation catalyst;

b) reaction of the reaction product from a) with

15 formaldehyde, an oligomer or a polymer of formaldehyde and  
15 at least one amine which has at least one secondary amino  
function and no primary amino function,  
or

20 c) reaction of the reaction product from a) with at least one  
adduct of at least one amine which has at least one secondary  
or primary amino function and formaldehyde, an oligomer of  
formaldehyde, a polymer of formaldehyde or a formaldehyde  
equivalent,

25 and are used as detergent additives in fuel and lubricant  
compositions, and additive concentrates, fuel compositions and  
lubricant compositions contain these Mannich adducts.

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